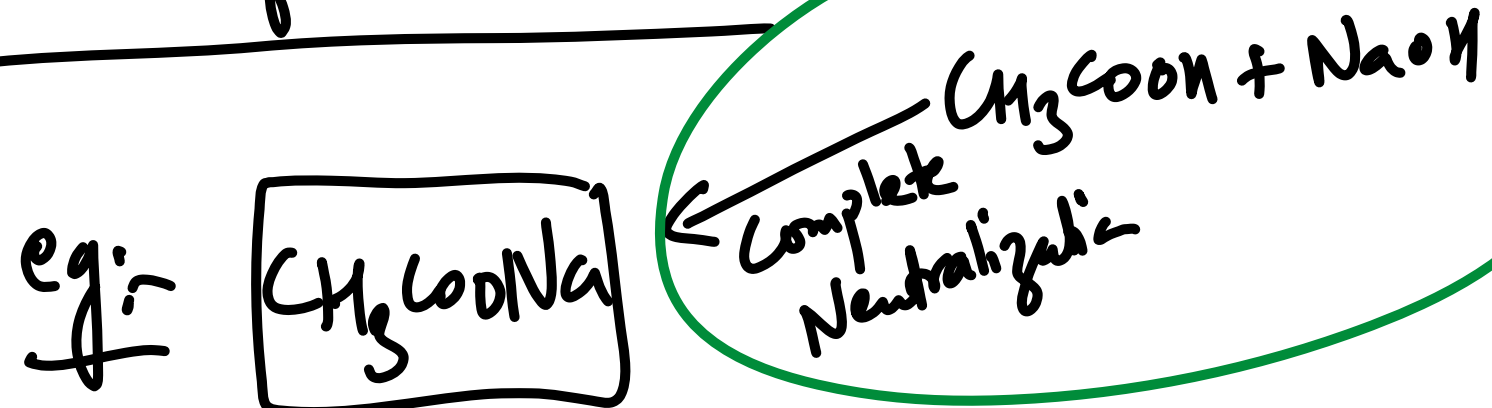
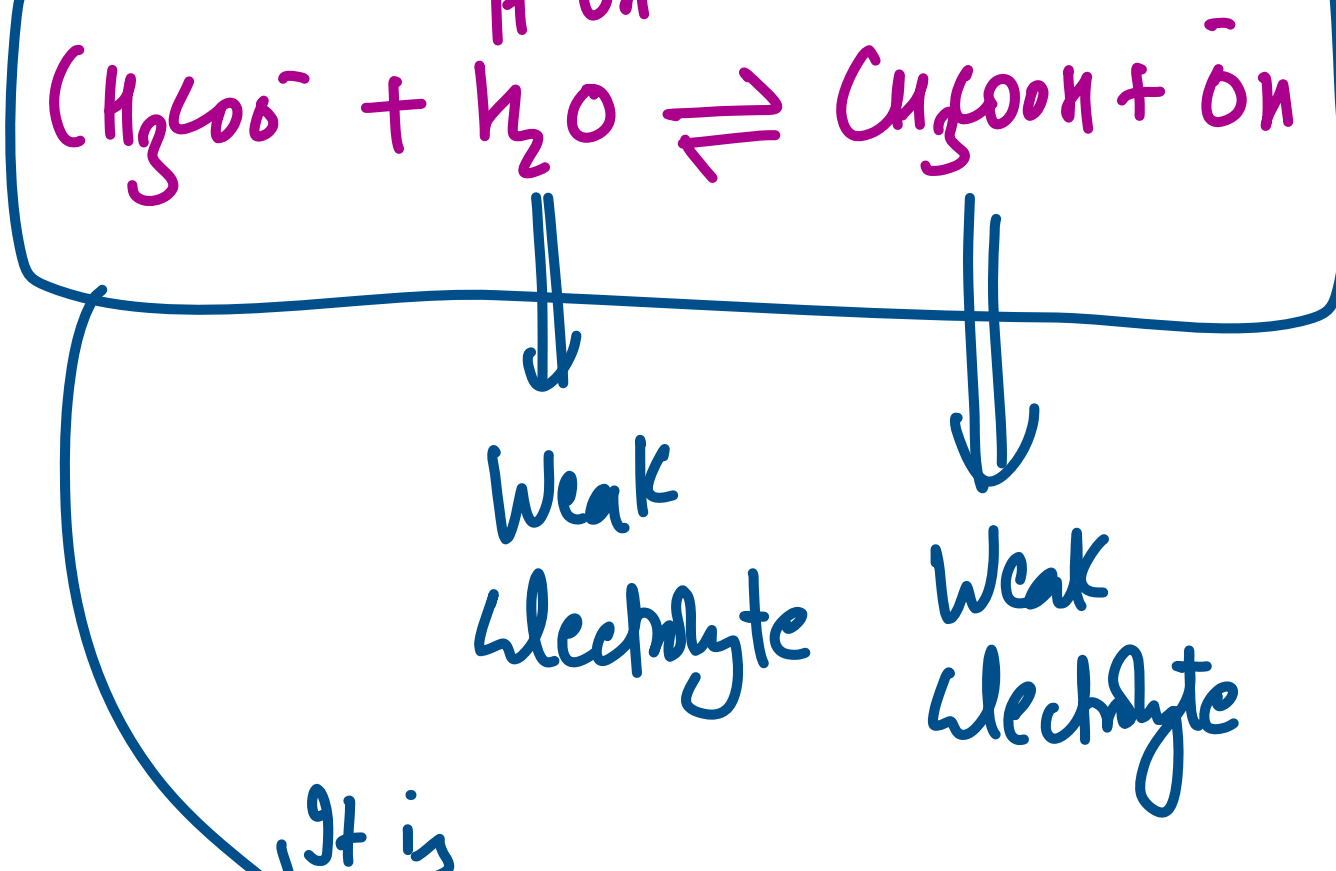
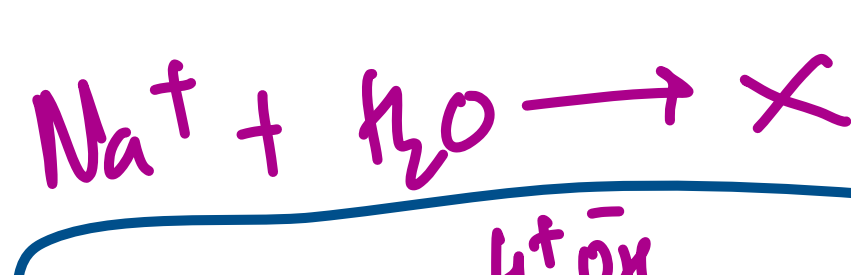
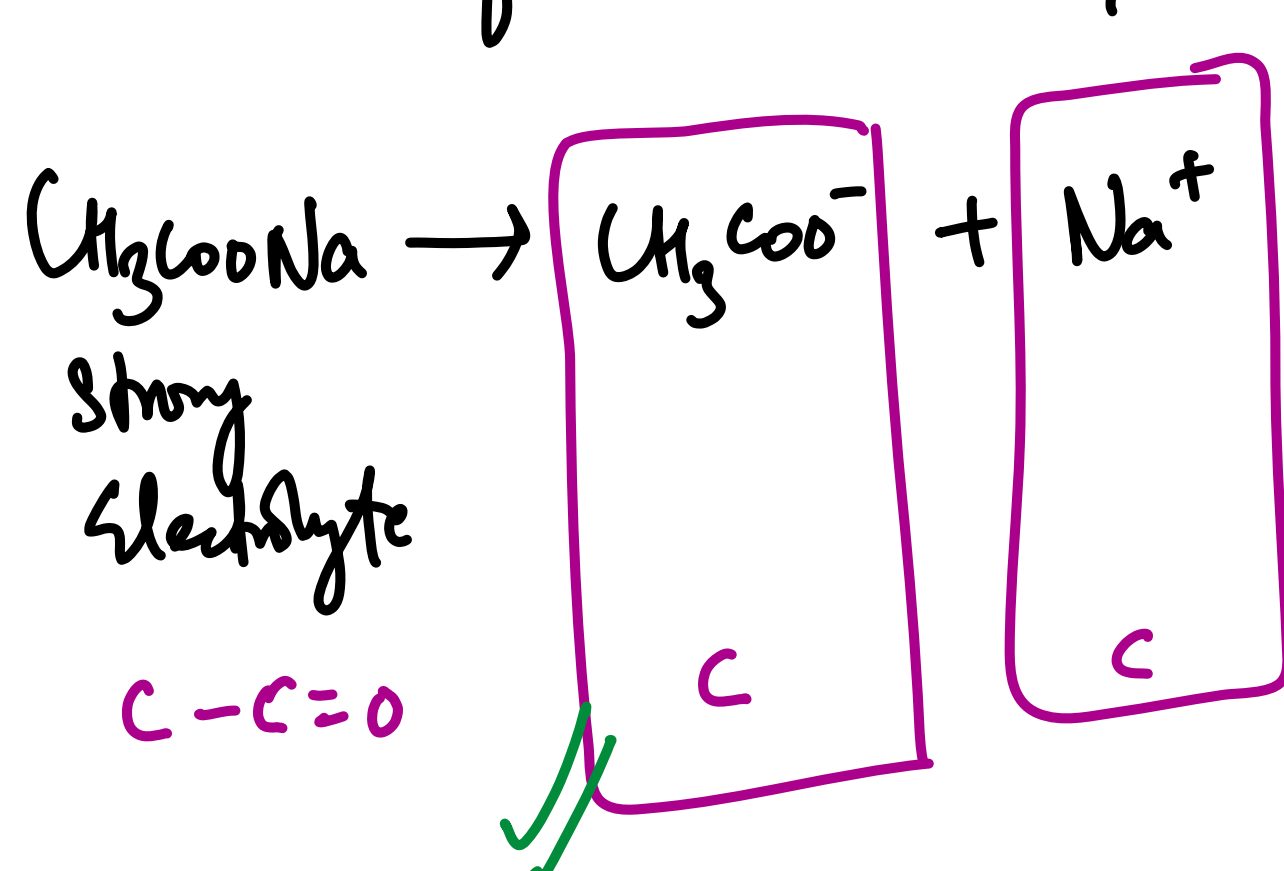


# I Salt of W.A + S.B



let conc. of Salt is  $c$  mol/L

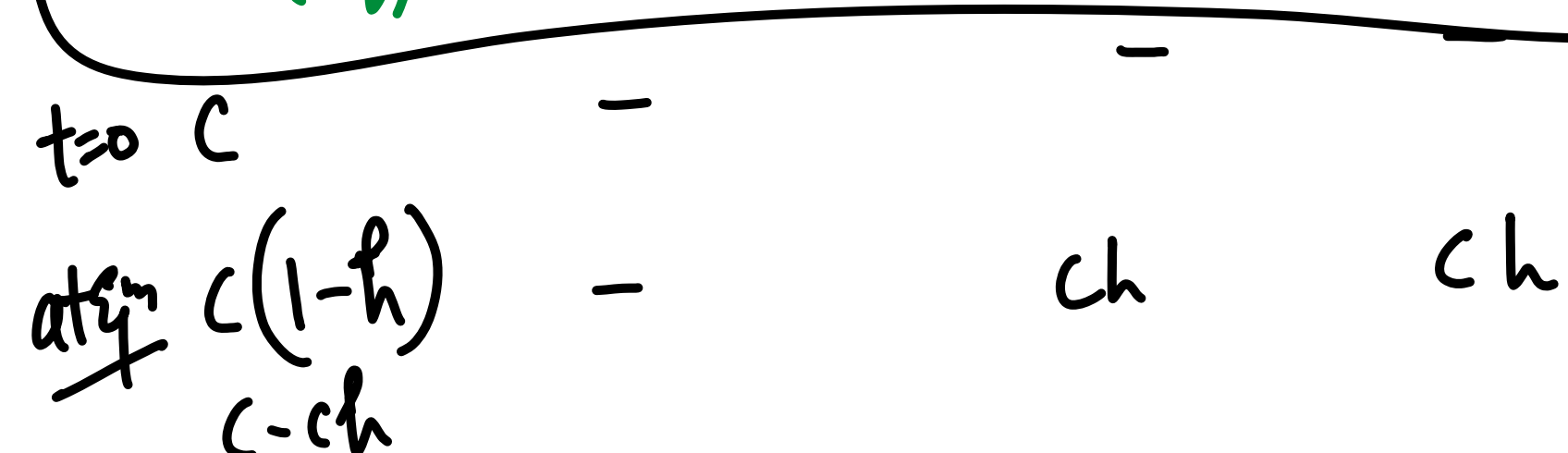
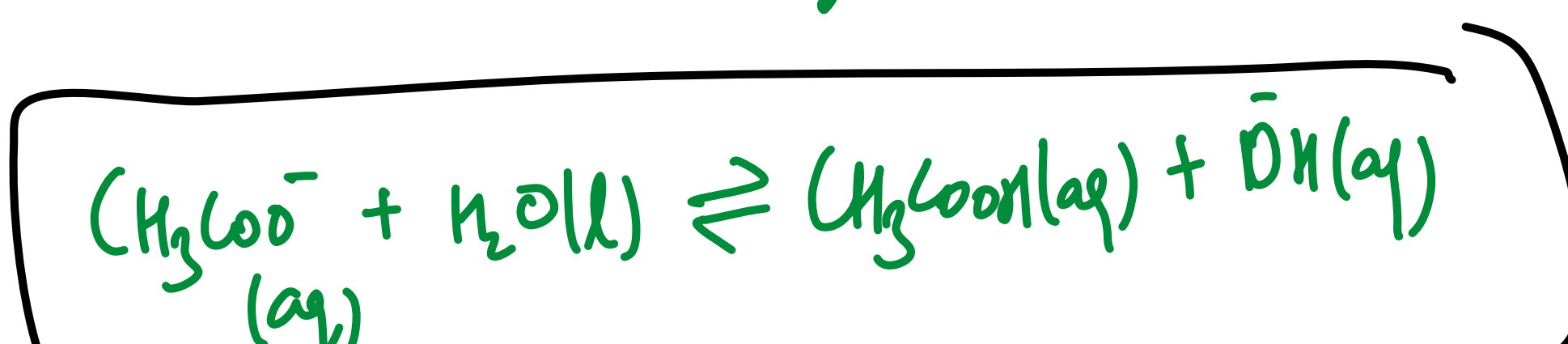
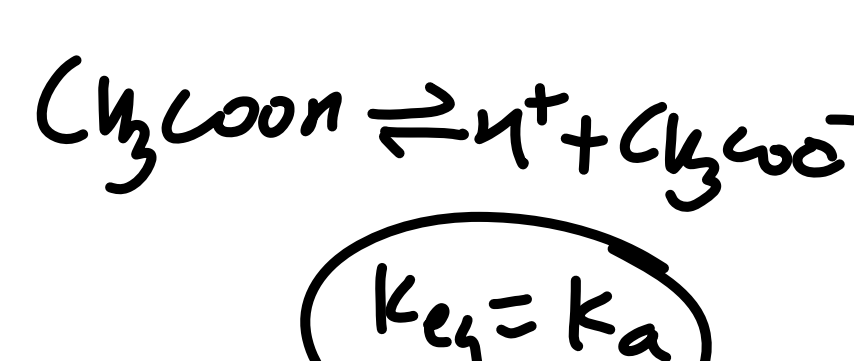


Anionic Hydrolysis

$[\text{OH}^-] > [\text{H}^+]$

Soln becomes Basic

$\text{pH} > 7$



$h \rightarrow$  degree of hydrolysis of anion.

$K_{eq} = K_h = \frac{[\text{CH}_3\text{COOH}][\text{OH}^-]}{[\text{CH}_3\text{COO}^-]}$

$K_h = \frac{ch \times ch}{c(1-h)} = ch^2$

$h = \sqrt{\frac{K_h}{c}} = \sqrt{\frac{K_w}{K_a \times c}}$

$[\text{OH}^-] = ch = \sqrt{c \cdot \frac{K_w}{K_a}}$

$-\log[\text{OH}^-] = -\log\left(c \cdot \frac{K_w}{K_a}\right)^{\frac{1}{2}}$

$\text{pOH} = \frac{1}{2}[-\log c - \log K_w - (-\log K_a)]$

$= \frac{1}{2}[-\log c + \text{p}K_w - \text{p}K_a]$

$\text{pOH} = \frac{1}{2}[-\log c + 14 - \text{p}K_a]$

$\text{pH} = 14 - \text{pOH} = 14 - \left(\frac{1}{2}[-\log c + 14 - \text{p}K_a]\right)$

$= 14 + \frac{1}{2}\log c - 7 + \frac{1}{2}\text{p}K_a$

$\text{pH} = 7 + \frac{1}{2}[\text{p}K_a + \log c]$

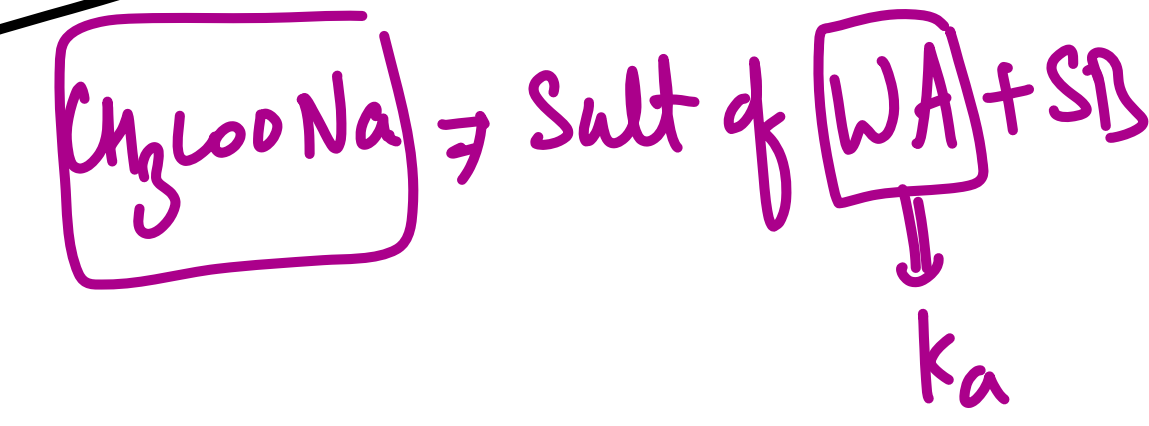
mostly  $h \ll 1$

$\rightarrow 1 - h = 1$

$K_w = 10^{-14}$

$\text{p}K_w = 14$

## Shortcut

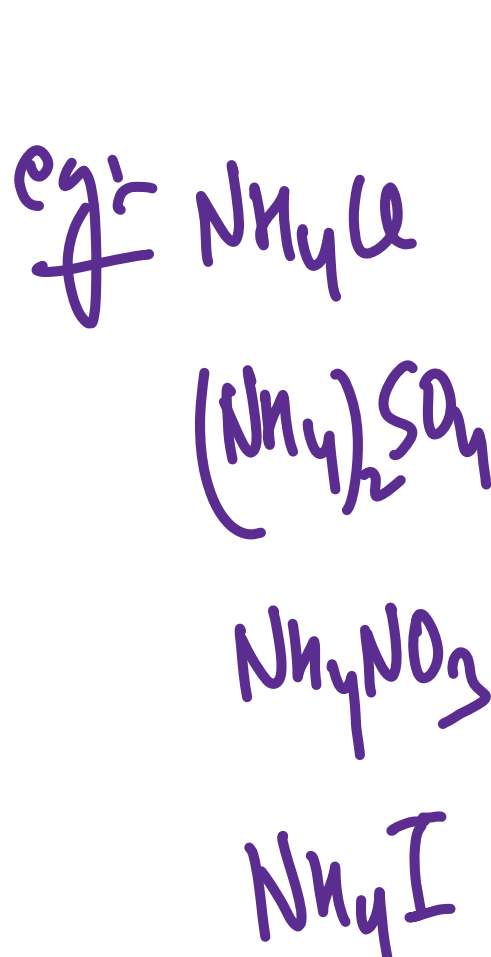


$\Rightarrow K_h = \frac{K_w}{K_a}$

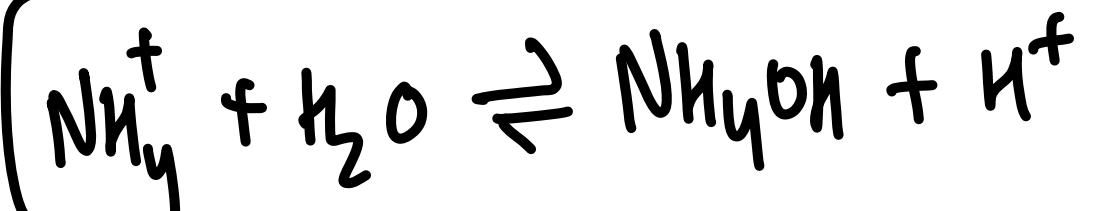
$\Rightarrow h = \sqrt{\frac{K_h}{c}}$

$\Rightarrow \text{AN} \checkmark \text{ pH} > 7 \quad \text{pH} = 7 + \frac{1}{2}[\text{p}K_a + \log c]$

## II Salt of Weak Base + Strong Acid



- Cationic Hydrolysis
- $[\text{H}^+] > [\text{OH}^-]$
- Acidic  $\text{pH} < 7$
- $\text{pH} = 7 - \frac{1}{2}[\text{p}K_b + \log c]$
- $h = \sqrt{\frac{K_h}{c}} \quad K_h = \frac{K_w}{K_b}$



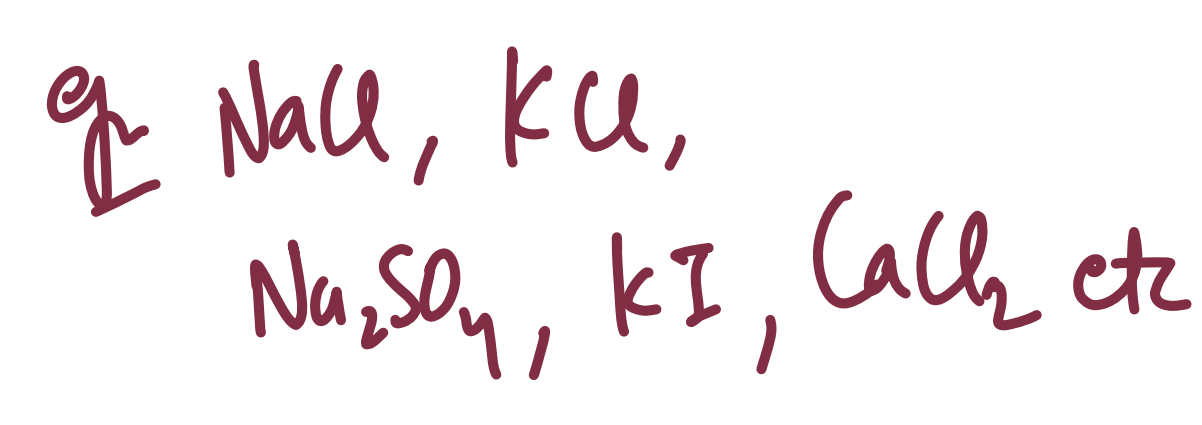
Conc. of Cation of Salt being hydrolysed

## III Salt of S.A + S.B

No Hydrolysis

$[\text{H}^+] = [\text{OH}^-] = 10^{-7} \text{ M}$

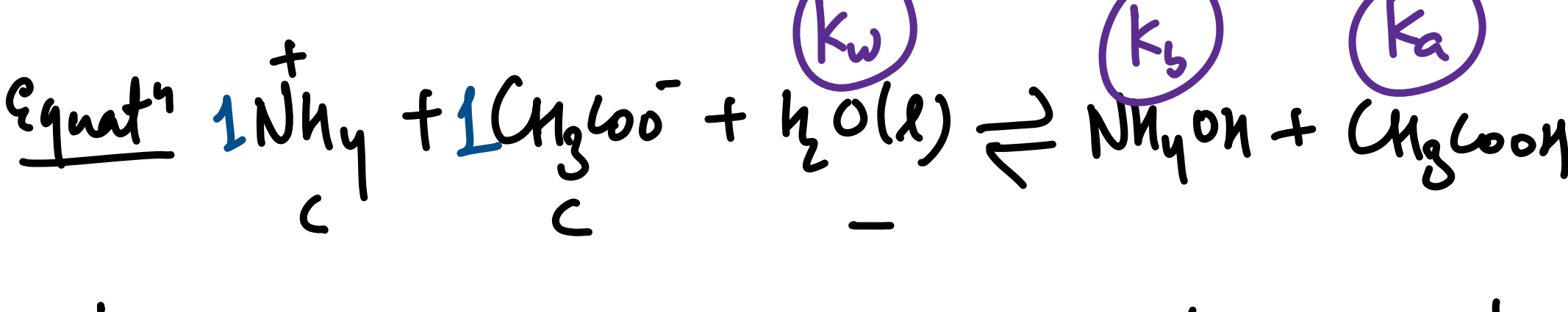
$\text{pH} = 7 = \text{pOH}$



## IV Salt of W.A + W.B



$\text{CH} \checkmark \text{ AN} \checkmark$



$K_h = \frac{ch \times ch}{c \times c} = h^2$

$h = \sqrt{K_h}$

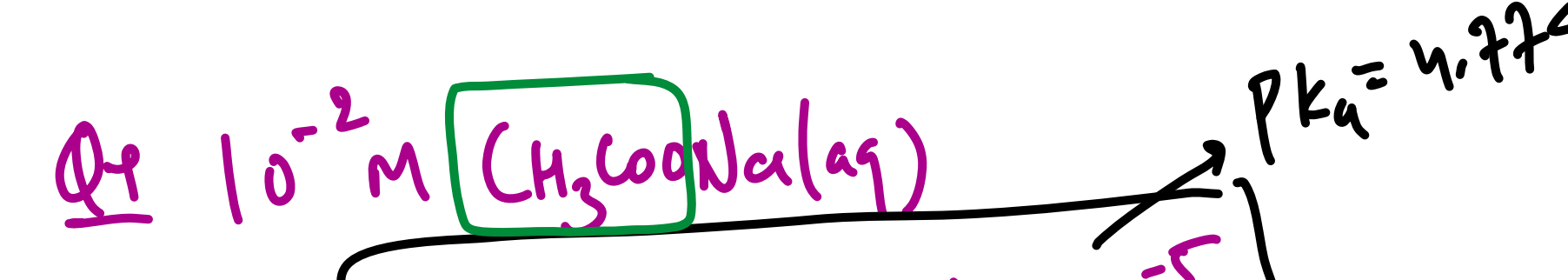
$K_h = \frac{K_w}{K_a \times K_b}$

$\text{pH} = 7 + \frac{1}{2}[\text{p}K_a - \text{p}K_b]$

independent of Conc.

$\text{p}K_a > \text{p}K_b$ ;  $\text{pH} > 7$  Basic

$\text{p}K_a < \text{p}K_b$ ;  $\text{pH} < 7$ , Acidic



$K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$



$K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$

Calculation (S-II)

$\text{CH}_3\text{COOH}$  (W.A)

$\text{p}K_a = 5 - \log(1.8) = 4.774$

$\text{pH} = ?$

$\text{AN} \checkmark$ ;  $\text{pH} > 7$

Soln:  $[\text{CH}_3\text{COO}^-] = 2 \times 10^{-2} \text{ M} = c$

$\text{pH} = 7 + \frac{1}{2}[\text{p}K_a + \log c]$

$= 7 + \frac{1}{2}[4.774 + \log(2 \times 10^{-2})]$

a)  $\text{pH} = ?$

b)  $h = ?$

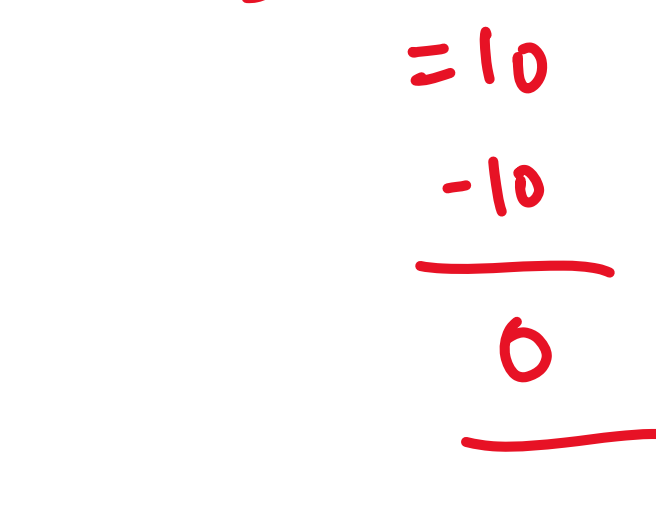
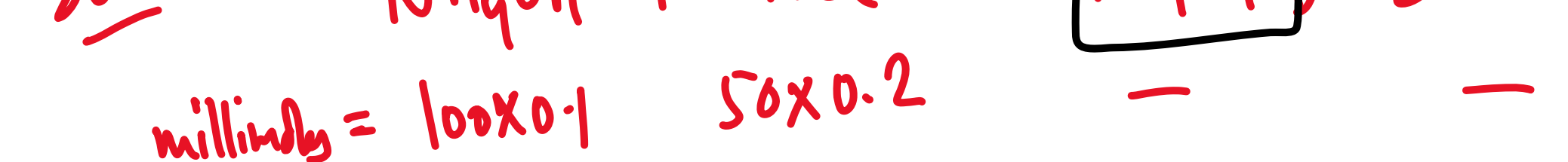
c)  $K_h = ?$

$h = \sqrt{\frac{K_w}{K_a \times c}}$



$(K_b = 10^{-5})$

$\text{pH} = ?$



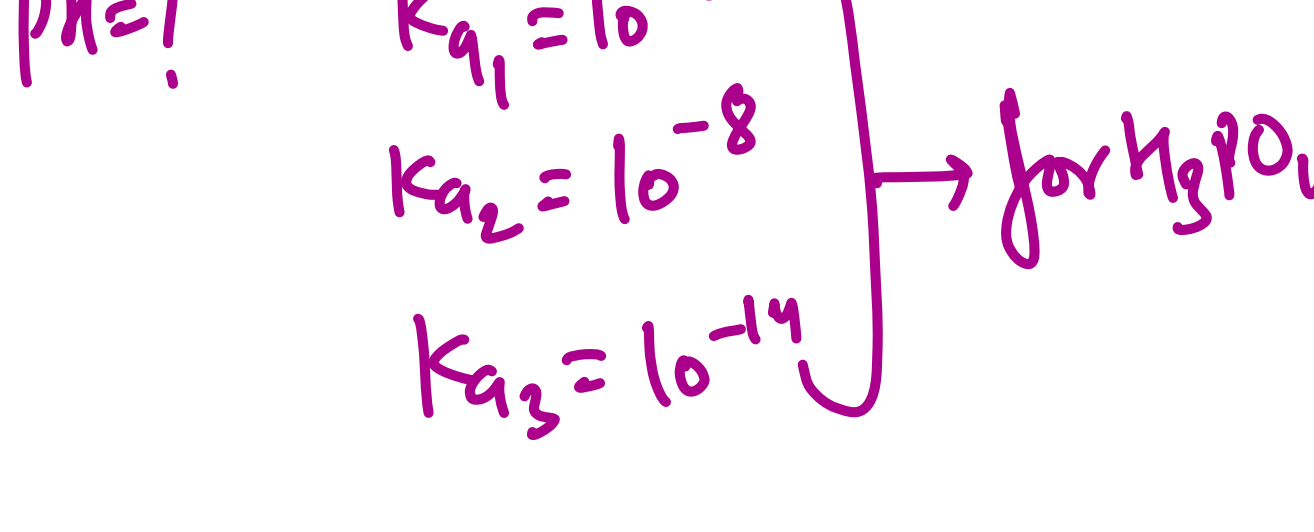
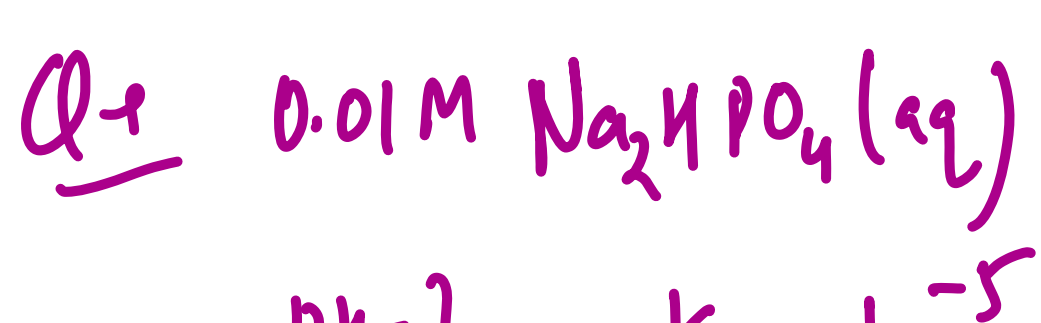
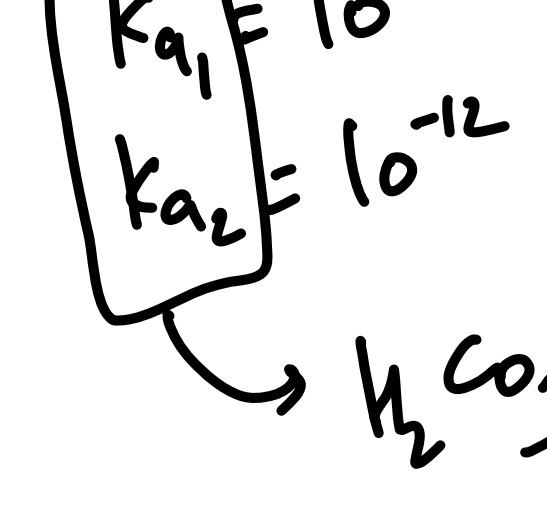
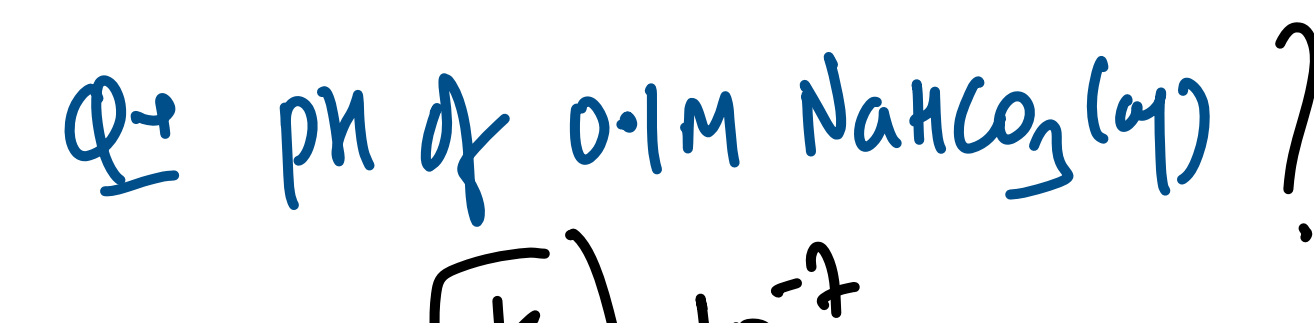
$[\text{NH}_4\text{Cl}] = 10 \times 10^{-3} \text{ M}$

$[\text{NH}_4^+] = \frac{1}{15} \text{ M} = c$

Container has salt &  $\text{H}_2\text{O}$ ; so it is question of Salt Hydrolysis

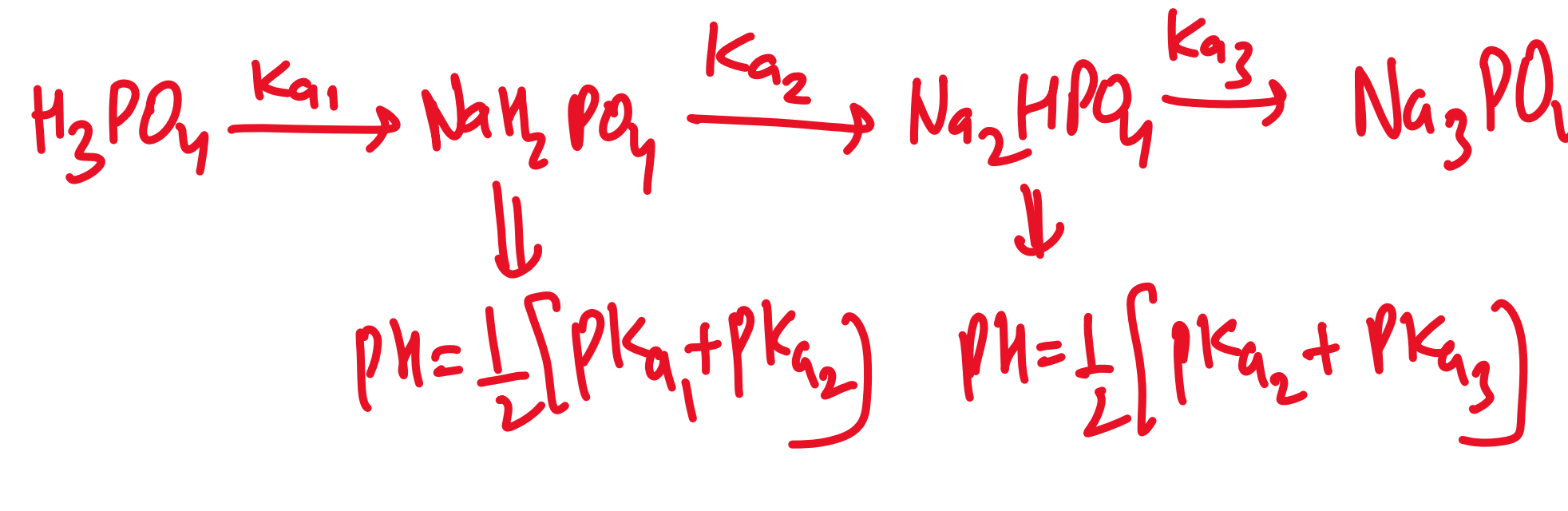
Cationic Hydrolysis  $\checkmark$  Acidic  $\text{pH} = 7 - \frac{1}{2}[\text{p}K_b + \log c] = 7 - \frac{1}{2}[6 + \log(\frac{1}{15})] = 7 - \frac{1}{2}[6 - 0.7 - 0.47] = 7 - \frac{1}{2}[5.23] = 7 - 2.615 = 4.385$

Note:- Salt Soln of Di or tri basic acid having atleast one  $\text{H}^+$



Soln:  $\text{pH} = \frac{1}{2}[\text{p}K_{a1} + \text{p}K_{a2}]$

Soln:  $\text{pH} = \frac{1}{2}[\text{p}K_{a2} + \text{p}K_{a3}]$



Solve Q:- 12, 13-138

Step 2  $\rightarrow$  1 to 32, 33, 34, 36, 37, 38, 50, 51, 52, 53, 54, 62, 63, 65, 66, 67, 68, 69, 70, 71, 72, 75, 76, 77, 79, 83, 90, 91, 92, 93, 94 to 132